PROCESS FOR USING RISK-BASED TOOLS AND APPROACHES IN THE DEVELOPMENT OF COMMERCIAL VEHICLE SAFETY PLANS

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1.0 Introduction

The Federal Motor Carrier Safety Administration (FMCSA) promotes Commercial Motor Vehicle (CMV) safety in part by providing federal funds to support state CMV safety programs. These funds are provided through the Motor Carrier Safety Assistance Program (MCSAP). States provide information on how these funds will be used and on the results of their safety improvement efforts using Commercial Vehicle Safety Plans (CVSPs).

During the past four years the CVSPs have been developed as performance-based plans. In this format problems are identified, strategies to address these problems are formulated, activities to implement these strategies are defined, and measures to assess the effectiveness of the activities are identified. A pilot project evaluated the value of enhancing the performance-based planning process by using the tools and techniques of risk-based planning. This pilot was undertaken in the states of New Mexico, South Carolina and Washington. The results of this pilot project are documented here in the form of guidance on how to enhance the performance-based planning process through application of the tools and techniques of risk management.

Before discussing the planning steps, a brief summary of the benefits that can be derived from supplementing the CVSP process with risk tools and techniques will be given:

- *Enhanced process for defining CMV safety issues (risks) and activities to resolve these issues.* In application at the pilot states the techniques discussed below have resulted in a more complete list of issues impacting CMV safety.

- *Improved mechanisms for evaluating and ranking candidate activities for improving CMV safety.* The tools discussed below include a simple technique for evaluating and ranking activities designed to resolve key CMV safety issues. This technique supports improved focusing of state resources on the activities of greatest potential value.

- *Expanded use of crash and violation data in focusing on significant CMV safety issues and in evaluating progress in improving CMV safety.* Experience in the pilot states has shown that opportunities exist for significant improvements in the use of crash and violation data in clarifying the importance of safety issues and in measuring performance in improving CMV safety.

- *Better mechanisms to integrate the activities of various agencies involved in CMV safety improvement.* The techniques discussed below include mechanisms to involve a broader
  - Set of knowledgeable safety professionals in identifying key issues and in determining how best to resolve these issues.

  - *Mechanism to focus on and expand support for needed legislative initiatives.* Both the comprehensive definition of CMV safety issues and the use of a broad group to define and characterize these issues support forming a strong constituency to seek needed legislation at the state or Federal level.

This document has been structured to support states that choose to employ some or all of the available risk-enhancements in developing their CVSPs. **Section 2** presents the essential features of a multi-step process for use by interested states. **Section 3** presents details of each of the risk enhancements to the CVSP process, including tools developed to support the process, in greater depth. **Section 4** summarizes the ways in which available data on crashes and violations can be used in better ways to support the performance management and evaluation processes.

2.0 Steps in the Risk-Enhanced Planning Process

This section summarizes the steps involved in a risk-enhanced version of the CVSP process. A more detailed discussion of the tools and techniques that have been developed to support this process is provided in Section 3.

2.1 Process Steps

The major steps in a risk-enhanced CVSP process are summarized below. These steps are presented in order from identification of a planning process leader and identification of key CMV safety issues through reviewing and improving the process at the end of the planning cycle. Because of the compatibility of the risk enhancements with the current performance-based process, the cycle outlined below can be initiated at several steps other than the beginning. One of the states in the pilot process, South Carolina, decided that their first process improvement need was in the use of data to evaluate the effectiveness of implementation of their plan. Therefore, they began the process at that step, and are now proceeding to the beginning of the planning cycle.

1. *Identify a Leader of the Planning Process*

Experience with collaborative planning processes has shown that the primary factor in assuring success of such efforts is the selection of a leader who is capable of commanding the respect of participants in the planning process and is committed to making the process work. Such a leader can be the person responsible for preparation of the CVSP, or can be assigned to lead the planning team in preparing planning input and in evaluating the success of the implementation effort.

2. *Assemble a cross-organizational planning team to implement the process*

This step, described in more detail in Section 3.1, allows a broader perspective to be focused on identifying key CMV safety issues as well as on defining candidate strategies for resolving these issues. In addition, a broadly constituted planning team (involving participants from various state and local agencies as well as representatives of the trucking and insurance industries) will provide a stronger constituency for seeking outside support for issue resolution, such as legislative action, where the responsibility for issue resolution lies outside the team.

3. *Define key CMV safety issues (risks)*

Definition of key CMV safety issues, carried out by the team discussed above, is the critical first step in developing an effective plan. This step, discussed further in Section 3.1, should use the expertise of the planning team, and should use crash and violation data to the greatest extent useful to develop a comprehensive set of CMV safety issues (risks). The result of this step is a consolidated set of safety issues for which resolution strategies can be developed.

4. *Identify candidate activities to resolve these issues*

For each of the key safety issues, one or more resolution strategy or activity should be developed. Again, the broad perspective of the planning team should be drawn upon to develop a list of candidate resolution strategies or activities, as discussed in Section 3.2. The next step in the process is evaluating these activities to determine their relative value. This evaluation process depends on a fairly clear understanding of how each strategy or activity will be undertaken. Experience has shown that a good test of the clarity of the activity definition is whether or not each activity is well enough understood that implementation costs can be estimated.

5. *Evaluate and rank candidate activities*

If the process is followed thoroughly to this step, there will be a large enough listing of candidate safety improvement activities that they can not all be pursued during the planning year. Therefore, a tool and process is needed to evaluate and rank the candidate activities so a decision can be made on which activities to pursue. Such a tool has been developed and tested during the pilot program, and is described in Section 3.3 (see Figure 3). The tool relies on a set of "weights" that describe the relative importance of several "attributes" or factors that can be improved to enhance CMV safety. One such "attribute" is "*Improvement of the Physical Condition of the CMV*". These weights can be derived from state-specific crash data, or can be developed using a subjective process that considers national data or data from other states. The process of evaluating candidate activities for incorporation in the CVSP again benefits from involvement of the planning team. The result of this evaluation process is one or more lists of candidate improvement activities ranked either by their "benefit" as determined by the evaluation process or by their benefit-to-cost ratio.

6. *Select the activities to be undertaken and enter into the CVSP*

This step is where resources are allocated to the best of the candidate improvement activities. The ranked lists developed in the step above should serve as guidance to, but not represent a constraint, on the planning process. The

manager(s) responsible for implementing the plan, and for improving CMV safety within the state, should use this expert perspective as input to their decision on what activities to pursue during the planning year. Other factors that should influence their decision on what activities to pursue should include the scope of their responsibilities and their experienced-based insights into which activities have the greatest potential for pay back. Activities to be pursued during the planning year should then be entered into the CVSP and measures of their effectiveness identified.

Some analysis performed with pilot states indicates that crash data can be used to support reallocation of "core" resources within a state CMV safety program. This analysis is described in greater detail in Section 3.3.1.

7. *Implement the plan*

Activities determined to have the greatest potential for improving CMV safety should then be implemented.

8. *Monitor activity progress and effectiveness*

A key ingredient in both performance-based and risk-based planning processes is monitoring the effectiveness of implementation and adjusting resource deployment based on this feedback. This process is discussed in Section 4. A team composed exclusively of people responsible for implementation of the plan may be the best group for monitoring implementation of the plan. Such a group will have insights into reasons for effectiveness (or ineffectiveness) of the planned activities, and is in a position to make adjustments to their activities if this is warranted. The cross-organizational planning team discussed in Step 2 may have value in monitoring plan implementation at a higher level. It could be assembled every six months to review issue resolution status for a set of issues that goes beyond the boundaries covered in the CVSP, but is relevant to CMV safety.

9. *Improve organization, completeness and availability of crash and violation data*

Risk-enhancements to the CVSP process must include consideration of how best to use crash and violation data to better understand CMV safety issues and to improve allocation of resources to improving CMV safety. The use of data is discussed in Section 4. A key to effective data utilization is the availability of a person who can "interrogate" the available data bases to seek insights into safety issues and into performance effectiveness.

10. *Review the process and implement improvements for the following year*

After completing a planning cycle, the planning team should meet to evaluate the benefits, strengths and limitations of the planning process. It should then provide recommendations for process improvements to the leader of the planning team as well as to FMCSA.

11. *Repeat the process in subsequent years*

After the initial application of risk-enhanced process, the process should be institutionalized and steps 1 through 10 above repeated in each planning year. The evaluation group should be maintained and continue to meet to assess progress (see step 8). The critical element for successful institutionalization is the presence of clearly defined responsibility for maintaining the planning process. This element requires that senior management in the state MCSAP agency understand the process, support its value, and ensure that successful completion of the process is included as a performance objective for a senior person in the agency.

The list of issues and the ranked list of activities from previous years serves as the starting point for the steps in subsequent years. The evaluation group should confirm that previously identified issues remain important concerns within the state and identify new issues. Similarly, the list of activities should be re-examined to ensure that the most effective activities for each issue have been defined. Any newly defined activities should be evaluated according to risk reduction and the risk reduction scores of previously defined activities should be updated. Activities that have been completed should be removed from the list. The activity rankings should be updated based on the latest evaluations and the plan should be implemented based on the updated priorities. Updated data should be used to support the identification of issues and the evaluation and ranking of activities.

2.2 Timing of Planning and Review Process

As noted earlier, risk enhancements to the CVSP process can begin at any of several points in the above steps. If the process is begun at step 1, then preparation of input to a CVSP can take as little as one month. The primary factor in

defining the time needed to implement the plan is the time required to assemble a planning team, and the difficulty of scheduling meetings of such a team. The most efficient way to proceed is to complete steps 1 and 2 using only telephone consultation with the FMCSA facilitator. Steps 3, 4, and 5 can then be completed in two meetings of about one and one half days each with the FMCSA facilitator. These two meetings could conceivably be held during the same week, or could be separated by as much as a month.

After preparation of the plan, review meetings, noted in steps 8 and 9, can be scheduled at quarterly or six-month intervals, depending on the desires of the state and on the availability of performance data. The first of these meetings should focus on the availability and form of the data to best support performance evaluation. Subsequent meetings should focus on the use of data to monitor program effectiveness and to help identify opportunities for improving CMV safety performance.

3.0 Process and Tools for Application of a Risk-based Approach

This section summarizes the processes and tools for application of the risk-based approach to the development of CVSPs.

3.1 Problem Identification

The first phase of a risk management approach, "Risk Assessment," consists of comprehensive identification of issues that represent CMV risks. This should involve a combination of quantitative and qualitative techniques, including data analysis and application of expert judgement. The degree of rigor of quantitative analysis is not necessarily the most important indicator of a sufficient risk assessment process, particularly when an organization is in the initial stages of applying a risk-based approach. It is more important that an organization's risk assessment effort includes a complete identification of the source of all important risks and an assessment of the magnitude of those risks using the best available information. As applied to problem identification as part of CVSP development, a structured and complete risk assessment process should involve:

- The use of CMV accident data (federal and state data bases)
- The judgement and experience of concerned parties in the state that are familiar with CMV safety issues
- Policies and mandates from FMCSA

These sources provide a diverse perspective on the special safety issues in a state. Use of data is important to identify high-crash or high-fatality areas and allows a focus on some causes of crashes. However, it may not be feasible to break down existing data in a way that reveals important trends in crashes or brings to light *all* important safety issues. To achieve a more comprehensive identification of issues, the knowledge and experience of organizations concerned with CMV safety within a state should be drawn upon, including:

- FMCSA Headquarters, Regional Resource Centers, and Division Offices
- State MCSAP and Enforcement Agencies
- DMVs or other State Licensing Agencies
- Other State Agencies with a Role in CMV Safety (e.g., Highway Departments, State Police)
- Local Agencies within State with a Role in CMV Safety
- State Motor Carrier Industry Organizations
- Insurance Companies
- Safety Advocates

Information on risk issues from these organizations may be obtained by convening a panel of representatives from these organizations to discuss important safety issues and develop a list of issues. Questions such as those listed in Appendix B can be used to stimulate discussion on key issues.
Because of the importance of safety issues related to CDLs, FMCSA strongly urges that the state evaluation group include representation from the state Department of Motor Vehicles or other state licensing agency.

Constituting such a group will have the added benefit of providing a forum for all agencies within the state having some role in CMV safety to discuss and agree upon the issues as input to their individual planning processes. Effectively used, this group will support development of optimal resolution strategies for CMV safety issues as well as provide a forum for periodic review (see Section 4.2) of the effectiveness of efforts to resolve the key issues. The group could serve as a supplement to existing internal accountability mechanisms.

Experience in several states with the trial application of risk tools and processes in support of the CVSP process has shown that analysis of available crash data in advance of the meeting of experts has proven useful in stimulating discussion and in focusing on certain types of issues. One structure of crash data that has use both in issue identification and in establishing priorities of activities designed to resolve the issues is a breakdown of the number of crashes by major crash contributing factors and severity of crash, as shown in Figure 1 below.

Figure 1
Example Presentation of Crash Data (District X, CMV Driver Caused)

Number of Crashes Resulting in the Following Consequences

Major Contributing Factor (Examples)	**Fatalities** (Weight = AA)	**Serious Injury** (Weight = BB)	**Injury** (Weight = CC)	**Tow Away** (Weight = DD)	**HazMat Spill** (Weight = EE)	**Less Serious Impact** (Weight = FF)
Unqualified Driver						
Alcohol Involved						
Excessive Speed						
Defective Brakes						
Roadway Defect						
Etc. • • •	•	•	•	•	•	•

These data should be prepared as follows:

- Recent crash data (for as many years as are available, up to three years) should be assembled at the state level and also separated according to the district in which the crashes occurred (if the data system allows a breakdown by district or area within a state), as in Figure 1 above;
- At both the state level and within each district, crash data should be separated into categories (crash-causing agent) in which the CMV driver was the major contributor to the crash, and in which the driver of the other vehicle (non-CMV) was the major contributor, as in Figure 1 above;
- At the state level and within each district and each category of crash-causing agent, crash data should be organized in matrices (see Figure 1 above) in which the number of crashes are presented, categorized according to the major contributing factors, with the severity of the crash being the other dimension of the matrix.

This breakdown of the data allows focus on the matrix cells that show the largest number of crashes. Because each matrix cell consists of a specific combination of crash severity and contributing factor, this will help the expert group focus on the factors contributing most heavily to the most severe accidents. If crash data are further broken down by geographical district and/or causal agent (CMV or non-CMV), this will allow additional focus on the safety issues, involving these contributors, that lead to severe crashes.

The list of CMV safety issues obtained from analysis of the available crash data and from the expert panel should be merged with the list of issues implied by federal policies and mandates to form one set of safety issues. This set of issues can then be used to focus development of candidate resolution strategies.

3.2 Development of Candidate Resolution Approaches

Development of candidate issue resolution strategies can also benefit from the diverse perspective provided by the expert panel discussed above. This could be accomplished by convening the same expert panel discussed above, which could be done as part of the meeting in which the group identifies major safety issues. This group can then work to develop a list of candidate resolution approaches for each of the identified issues.

3.3 Priority Setting and Resource Allocation

After significant CMV risks have been identified and potential resolution strategies identified, the next steps are to set priorities for implementing the strategies and allocate resources to the activities that carry out the strategies. The nature of the activities carried out under MCSAP grants to control CMV risks suggest a different approach be taken towards priority setting and resource allocation, depending on the category of activity and the MCSAP funding category being used to fund the activity. Two categories of activities require different treatment: "Core" activities, and "Improvement" activities. "Core" activities are those routinely carried out in pursuit of CMV s
which need to be carried out once to improve the environment or infrastructure (physical as well as informational) in which CMV safety is managed, activities carried out to target specific safety issues, or activities carried out in pursuit of specially mandated or defined safety initiatives. Examples of core activities would be roadside inspections, routine traffic enforcement, and compliance reviews. Examples of improvement activities might include:

- Implementing measures to ensure driver accountability (e.g., implementing improvements to the CDL program);
- Securing legislative authority to certify new carriers before they are allowed to begin business;
- Implementing a web-based communication system to provide data to truckers and enforcement officers about unusual roadway conditions or hazards ;
- Special public outreach initiatives;
- Team building efforts between different state agencies.

In the context of the CVSP, core activities would typically be funded under the Basic Motor Carrier Safety Programs and improvement activities would typically be funded using Performance Incentive Grants.

Because these two types of activities are considerably different in the people responsible for their implementation and in the magnitude of resources required, the process for allocating resources will be different. The starting point for supporting allocation of resources among *core* activities will involve analysis of crash data, comparison of the results of this analysis to the current resource allocation, and adjustment to the resource allocation based on this comparison. Supporting allocation of resources for *improvement* activities will involve a combination of analysis of crash data and assembly of the subjective judgement of experts on both the implications of the data and the real causes of problems underlying the data. Section 3.3.1 will focus on allocation of resources among core activities, while Section 3.3.2 will describe the allocation process for improvement activities.

3.3.1 Resource Allocation to "Core" Activities

Historically, the vast majority of resources provided to states in the MCSAP grants are utilized in support of "Core" activities. These core activities include:

- Driver inspections
- Vehicle inspections
- Compliance Reviews
- Traffic enforcement
- Data collection, processing, dissemination and reporting
- Public awareness activities
- CDL enforcement
- Training of people whose jobs impact CMV safety (e.g., local CMV enforcement officers, new drivers, new company managers, company officials and dispatchers, other public officials)
- Border policing
- Company and driver certification

For some of these activities the resources required are dictated by the specifics of the job (e.g., company and driver certification), but for the majority, considerable discretion is possible in allocating available resources. This section

discusses a simple approach to allocate these resources to these core activities. This approach is intended to provide an allocation that targets resources to the level and types of CMV risks that exist in each region of a state.

Since most of these activities are managed within states at the *district* or *region* level, the first question that needs to be addressed is: *How should the available resources be allocated among districts or regions within a state?* The first step in answering the question about inter-district resource allocation within a state is to assemble data on the distribution of crashes among districts within the state. The beginning of this process was described in Section 3.1. The data developed as described in that section should then be analyzed as follows.

- An "importance factor" should be developed for each district and for each crash causing agent (CMV or non-CMV) by first assigning numerical weights to each level of crash severity (see example in Figure 2), and then adding (across all consequence levels) the product of each consequence weight times the total number of crashes having that consequence.
- The importance factors for each district should then be compared with the relative number of CMV safety professionals carrying out discretionary core activities within that district, and assignment of new safety officers made consistent with the results of that comparison. The principal is to allocate personnel proportionately to the level of CMV risk for a region, as represented by the importance factor. The actual allocation of people will necessarily involve subjectivity as well as management knowledge of special problems that may not be reflected in the historic data (e.g., major road construction or repair in one district, or a significant increase in traffic resulting from the opening of a new factory in a district)

The second question that needs to be addressed is: *How should resources within a district be allocated to the range of core activities?* The allocation of safety professionals *within each district* to the different types of core activities can be made by considering the expected impact of each type of activity on the crash-causing problems being experienced within the district. For example, if a major contributor to severe crashes within a district were shown by the data analysis above to be factors related to the driver of the other vehicle (non-CMV), then personnel assignments could emphasize activities that impact the safe driving behavior of non-CMV drivers (e.g., "No Zone" and other public education efforts).

A systematic analysis to support the allocation of resources to different activities within a district would involve the following steps:

- For the district in question, obtain the two matrices described above (Figure 1) presenting contributing factor data for crashes caused primarily by the CMV, and for crashes caused primarily by the other motorist (non-CMV);

- Use the data in these two matrices to develop district-specific weights for the project evaluation matrix (see Figure 3 below). The project evaluation group will first need to agree on the weights associated with the attributes shown on the left hand column of the matrix. Input to these weights should be developed by sorting available crash data into causal categories associated with these attributes. The *relative frequency* of severe crashes caused primarily by each attribute could be determined from the crash data, and used as initial weights. The evaluation group could then determine the weights associated with attributes for which crash causal data are not available, such as the "management culture and practices" attribute.

  Weights associated with the activity effectiveness scale (columns A through E of the matrix) could then be determined by the evaluation group using subjective judgement. The reasonableness of the weights could then be determined by evaluating and scoring a set of candidate improvement activities, and assessing the reasonableness of the resulting priority order. Modest adjustments could then be made to the weights, and the evaluation could proceed.

- Formulate a list of the candidate core activities for which the District has responsibility (see the list at the beginning of this section as an example);

- Identify several focused sub-activities (with associated resources) for each of the candidate core activities. If possible, describe these sub-activities so that each has a fairly well defined outcome, or is associated with a well defined block of resources (e.g., the resources applied to that core activity during the previous year, an incremental 20% increase in resources over the previous year core activity).

- For each identified sub-activity, use the evaluation matrix to subjectively determine how effective the activity would be in reducing the applicable cause of crashes (see Section 3.3.2 on priority setting for improvement projects using the evaluation matrix).

- List the sub-activities in priority order.

- Conduct a management review of the priority list and a make a management decision, including consideration of the priority list, on which core activities should be funded to achieve the maximum level of improvement in CMV safety during the year.

- Input these activities into the CVSP along with measures of how effective they will be in improving CMV safety.

Figure 2
Example Calculation of Importance Factor from Crash Data
(District X, CMV Driver Caused)

Crash Severity Level	**Fatalities**	**Serious Injury**	**Injury**	**Tow Away**	**HazMat Spill**	**Less Serious Impact**
Severity Weight	W_1 =AA	W_2 =BB	W_3 = CC	W_4 = DD	W_5 = EE	W_6 = FF
Number of Crashes	A_1	A_2	A_3	A_4	A_5	A_6

Importance Factor for District X, CMV Caused = $\sum W_i A_i$

Figure 3
Candidate CVSP Evaluation Matrix

Attribute Characteristics		**Expected Activity Effectiveness**				
		A. High	**B. High/Medium**	**C. Medium**	**D. Medium/Low**	**E. Low**
Attribute	**Weights \ Y**	**9**	**7**	**5**	**3**	**1**
Improve CMV Driver						
1. Error		1A	1B	1C	1D	1E
2. Impairment		2A	2B	2C	2D	2E
3. Fatigue		3A	3B	3C	3D	3E
4. Experience		4A	4B	4C	4D	4E
Improve POV Driver					5D	
5. Error		5A	5B	5C	6D	5E
6. Impairment		6A	6B	6C	7D	6E
7. Fatigue		7A	7B	7C	8D	7E
8. Experience		8A	8B	8C		8E
9. Improve Truck		9A	9B	9C	9D	9E
10. Improve Roadway		10A	10B	10C	10D	10E
11. Improve CMV Company Management Culture & Accountability		11A	11B	11C	11D	11E
12. Improve State Management Systems & Processes		12A	12B	12C	12D	12E

3.3.2 Resource Allocation to Improvement Activities

The evaluation matrix shown in Figure 3 above is designed to allow a group (composed of people with knowledge of the key CMV safety issues and perspective on the range of activities which support resolution of these issues) to provide input to the priority setting process. The ultimate purpose of this evaluation would be to establish priorities for the candidate activities so CMV safety experts can focus their efforts on those activities with the greatest potential to reduce CMV risk within the state.

The matrix is structured with a set of "attributes" along the left hand column. These attributes (defined in Appendix A) represent the major factors related to CMV crashes that activities funded by MCSAP funds might be expected to improve:

- The driver of the CMV,
- The driver of other vehicle (non-CMV),
- The CMV itself,
- The roadway,
- The management culture or practices in companies operating CMVs,
- The management systems and processes used by state agencies in promoting CMV safety.

The columns of the matrix describe subjectively the effectiveness of an activity under consideration in improving the attribute. For example, a given activity might be designed to improve the physical condition of CMVs on the highway. Therefore it would impact attribute number 9 in the matrix. If in the judgement of the evaluation group, the activity would have a medium effectiveness in improving the physical condition of the CMV relative to other similarly focused activities, then the activity under consideration would be scored as a 9C. The numerical value associated with matrix position 9C would be determined by multiplying the weight if the attribute times the weight of the expected activity effectiveness.

To use this matrix, the project evaluation group will first need to agree on the weights associated with the attributes shown on the left hand column of the matrix. Input to these weights should be developed by sorting available crash data into causal categories associated with these attributes. The *relative frequency* of severe crashes caused primarily by each attribute could be determined from the crash data, and used as initial weights. The evaluation group could then determine the weights associated with attributes for which crash causal data are not available, such as culture and practices" attribute.

Weights associated with the activity effectiveness scale could then be determined by the evaluation group using subjective judgement. The reasonableness of the weights could then be determined by evaluating and scoring a set of candidate improvement activities, and assessing the reasonableness of the resulting priority order. Modest adjustments could then be made to the weights, and the evaluation could proceed.

4.0 Uses of Data and the Performance Evaluation Process

The effective use of data is fundamental to any performance or risk-based management process. Collection and analysis of performance data must, therefore, be effectively integrated into the CVSP process. The people responsible for data assembly and analysis need to have a strong working relationship with those responsible for managing CMV safety-improvement activities, so their needs can be understood and supporting analysis performed on a timely basis. The collection and analysis of data should not be focused on satisfying externally imposed reporting requirements, but rather should be designed to aid the officers in the field in the effective performance of their jobs.

4.1 Uses of Data

Data may be employed in five areas in support of CMV safety. Each of these is discussed below.

1. *To evaluate trends in the level of "core" activity* Data can be used to describe level of activity (e.g., the number of level three inspections or the number of compliance reviews conducted within a specific period). These data are most useful if they are presented as trends, accompanied by some statement of management intent (e.g., this year we are emphasizing level three inspections), and presented so that the number of people conducting the particular activity are explicitly noted (e.g., the number of inspectors qualified and assigned to conduct level three inspections increased this year from 8 to 10). Such measures are primarily designed to answer the question: " Are we working hard?" These measures allow interim, short-term evaluation of the effectiveness of efforts in pursuit of safety. Such measures are useful in the interim before data are available to track trends that provide a more direct measurement of activity effectiveness (see 2 below).

2. *To determine the overall effectiveness of "core" activities* Data can be used to determine how effectively people are working (e.g., the percentage of level three inspections leading to out-of-service (OOS) violations decreased from 55% last year to 50% this year, or the percentage of stops to check for drugs and alcohol that led to finding driver impairment increased from 15% to 40%, or the number of fatal crashes per CMV mile driven in our state decreased by 15% last year compared to the previous year). In defining performance measures that characterize effectiveness, care must be taken to avoid "incentivizing" inspectors to overlook violations, as could be the case if, in the first example above, inspectors believed their performance was being linked to reduction in the number of OOS violations identified per inspection. Effectiveness data are most meaningful if they are presented as trends over several years, and the information is presented as "normalized e.g., crashes or fatalities per million CMV miles driven in the state). Such measures are primarily designed to answer the question: "Are our efforts having a positive impact on CMV safety?"

3. *To evaluate the appropriateness of the allocation of "core" resources* Data on crashes of various severity can be used to assess whether the physical areas in a state (e.g., specific Districts within a state or specific roads within a District) are receiving attention in proportion to the significance of the risk present there. The analysis described in Section 4.3.1 uses crash data in this manner to assess how the allocation of officers among the Districts in a state is related to the crash experience in the Districts. Such measures are primarily designed to answer the question: "Could we be having an overall more positive impact on safety by focusing on different activities or activities in different Districts?"

   It is recognized that other factors within a state may prevent proportional shifting of resources or staffing according to a risk-based allocation. However, if data can be used to illuminate the allocation of risk in a state, then this provides important information to support decisions on the allocation of existing resources and the allocation of any new resources that might become available.

4. *To provide insights into issues that impact the effectiveness of efforts* If the proper data are available on crash reports, then those data should be useful in characterizing the relative significance of issues that may be addressed by programs the agency can institute or may require legislative initiative. Questions such as the following fit in that category: Do drivers with suspended licenses or under court supervision contribute disproportionately to crash rates? Do inexperienced drivers contribute disproportionately to crash rate? Do intrastate carriers contribute disproportionately to crash rate? What is the percentage of CMV crashes that are caused by cars? What fraction of CMV crashes are attributable to changes in controllable factors such as speed limit? What fraction of crashes involve HazMat carriers? Are the consequences of HazMat crashes (e.g., duration of road way closure) significantly greater that those of other CMV crashes? Such measures are primarily designed to answer the question: "Are we impeded or constrained in any non-productive ways in the pursuit of our activities? or, Are there concerns beyond our control that adversely impact our ability to improve CMV safety?"

   Having data analyses available to give insight into the possible answers to these questions will help stimulate discussion among the members of a state inter-organizational evaluation group that is attempting to identify CMV safety issues. In turn, if the group's discussion identifies potential issues related to risk contributors that cannot readily be evaluated using available data, then these data may be pursued during the period between group meetings.

5. *To improve the quality, usefulness and availability of data processed by analysts in support of improving CMV safety* Data are usually available to headquarters managers who use it to assess how effectively resources are being deployed to achieve improvements in CMV safety. These same data might be even more useful if they were readily available to officers in the field to help support day-to-day decisions such as where to locate officers to patrol for moving violations. The form and accessibility of data require careful consideration to ensure they are used effectively to achieve CMV safety improvements.

See Appendix C for a sample list of data that may be useful in supporting the steps of the risk-enhanced CMV safety planning process.

4.2 Performance Evaluation Process

A risk-based approach may be used by a state MCSAP agency to evaluate the state's progress in implementing the risk control activities included in its CVSP. The performance evaluation process needs to satisfy the following general guidelines:

- Performance measures should be established to evaluate both the completion and the effectiveness of all improvement activities.
- Performance measures should be established to evaluate the effectiveness of resource allocation within each district in the state as well as at the state level.
- Periodic meetings (e.g., six month intervals) should be held involving the expert team used to identify issues and candidate resolution activities. Because of the diverse nature of the group it can monitor the effectiveness of safety improvements implemented by various state agencies with a role in CMV safety. In addition, this same group can update the set of CMV safety issues and can suggest innovative means to resolve these issues. This process will support reallocation of resources among core and improvement activities within the state.
- Periodic meetings (e.g., quarterly) should be held among the officers responsible for managing the major CMV safety activities in the MCSAP agency. This group should monitor the effectiveness of safety improvement efforts using data on crashes, roadside inspections, compliance reviews, and traffic enforcement. These meetings also provide an opportunity for the managers to share experiences, implementation details, best practices, etc., from the different operating units or areas in the state.

Appendix A – Attribute Definitions

The following general definitions of the attributes used in the evaluation matrix apply in New Mexico. Similar definitions will need to be prepared by each state in which crash data are used to develop state-specific weights for the evaluation matrix.

1. Improve CMV Driver: Error

This attribute is intended to describe how activities can reduce risks associated with the following CMV driver contributing factors:

- Passed red light
- Passed stop sign
- Failure to yield
- Excessive speed
- Excessive speed for conditions
- Driving left of the center line
- Following too close
- Improper turns
- Improper overtaking
- Improper lane change
- Improper Backing

2. Improve CMV Driver: Impairment

This attribute is intended to describe how activities can reduce risks associated with the following CMV driver contributing factors:

- Alcohol use
- Drug use

3. Improve CMV Driver: Fatigue

This attribute is intended to describe how activities can reduce risks associated with the following CMV driver contributing factors:

- Driver inattention
- Crash with empty vehicle

4. Improve CMV Driver: Experience

This attribute is intended to describe how activities can reduce risks associated with the following CMV driver contributing factors:

- Poor driving
- Avoid pedestrian
- Avoid vehicle

5. Improve Other Motorist: Error

This attribute is intended to describe how activities can reduce risks associated with the following other motorist contributing factors:

- Passed red light
- Passed stop sign
- Failure to yield
- Excessive speed
- Excessive speed for conditions
- Driving left of the center line
- Following too close
- Improper turns
- Improper overtaking
- Improper lane change
- Improper Backing

6. Improve Other Motorist: Impairment

This attribute is intended to describe how activities can reduce risks associated with the following other motorist contributing factors:

- Alcohol use
- Drug use

7. Improve Other Motorist: Fatigue

This attribute is intended to describe how activities can reduce risks associated with the following other motorist contributing factors:

- Driver inattention
- Crash with empty vehicle

8. Improve Other Motorist: Experience

This attribute is intended to describe how activities can reduce risks associated with the following other motorist contributing factors:

- Poor driving
- Avoid pedestrian

9. Improve CMV

This attribute is intended to describe how activities can reduce risks associated with the following contributing factors:

- Defective steering
- Defective tires
- Defective brakes
- Mechanical defect

10. Improve Roadway

This attribute is intended to describe how activities can reduce risks associated with the following contributing factors:

- Road defect
- Skid - no braking
- Traffic control out

11. Improve CMV Management Culture or Accountability

This attribute is intended to describe how activities can reduce risks associated with the effect of management culture or practices.

12. Improve State Management Systems and Processes

This attribute is intended to describe how activities can improve CMV safety by enhancing the management systems and practices in the state agencies with some responsibility for the safety of commercial vehicles.

Appendix B

Questions to Guide Identification of Issues in the CVSP Process

Institution-Related

- How are crash and violation data available and used to focus resources and evaluate agency performance?
- Can useful safety data be accessed by officers on the highway and their management? How?
- Are driver qualification requirements (e.g., training, licensing, re-licensing) adequate?
- How are candidates for Compliance Reviews selected (both interstate and intrastate)?
- Are there any state or federal laws (or practices or impediments) that adversely impact CMV safety or enforcement that promotes CMV safety (e.g., speed limits, political bias toward CMV operators)?
- Are the relationships between the state enforcement people and the local authorities mutually supportive? Are data exchanges adequate? Are reporting practices consistent?
- Is a formal process in place through which information on crash causes is shared among state agencies with a role in CMV safety?
- Are state police officers trained and qualified to inspect CMVs? Do they routinely practice these functions? How do they select CMVs for inspection?
- Are there changes in internal management systems that will support improvements to CMV safety (e.g., clarity of responsibilities, resource allocation, communications, performance data)?

CMV Driver-Related

- What driver-related factors contribute most significantly to CMV crashes?
- Are rest stops adequate to accommodate CMV traffic through the state?
- Do drivers have adequate access to information on road conditions (e.g., weather, construction & maintenance)?
- Do inspections include a check of driver CDL status?
- Does court disposition of driver violations ensure accountability and provide appropriate recording of serious driver violations?

Related to the Operator of the Other Vehicle

- How significant (%) is the impact of POVs on CMV crashes?
- What are the likely causes of these POV-caused crashes?
- Are POV drivers adequately prepared and qualified to share the road with CMVs?

CMV-Related

- How are vehicles selected for inspection?
- Are there unique safety problems associated with passenger carriers?

Roadway-Related

- Are the high crash zones in the state well understood?
- Are the high crash zones monitored and communicated to responsible officers?
- Are special conditions impacting crash rate (e.g., weather, road maintenance & construction, uncleared crashes) monitored to support placement of traffic enforcement officers?
- Are problem roads conditions communicated to motorists and CMV drivers?
- Do road features (e.g., signage, rumble strips) in high crash areas adequately support driver awareness of conditions and alertness?

Company Management-Related

- Are companies that operate CMV adequately qualified (e.g., knowledgeable of regulations, aware of safety technology, committed to truck maintenance, committed to driver development and qualifications)?
- Do shipper requirements contribute to crashes?
- Do managers and dispatchers of trucking companies contribute to crashes? How?

Appendix C

Sample Data Needs for State CVSP Development Process

Support Performance Evaluation (and Resource Management) Annual CMV miles driven in State (total as well as on each major highway); if possible separate out motor coach miles from other CMV miles

- Total annual vehicle miles driven in State (total as well as on each major highway)
- Number of lane restrictions (construction, maintenance) on major highways
- Measure of lanes available for travel on major highways in State (desire to get measure of traffic density)
- Measure of statistical variability of CMV fatal crashes and injury crashes in State
- Quarterly and annual reports on CMV crashes (fatal, injury, tow-away, significant vehicle damage) by District
- Quarterly and annual maps of CMV crashes (fatal, injury, tow-away, significant vehicle damage) on major highway in State
- Map showing location of alcohol-related CMV crashes
- Quarterly and annual reports on motor coach crashes (fatal, injury, tow-away, significant vehicle damage)
- Map showing CMV traffic citation distributed along major highways (number & type)
- Map showing CMV number of fatigue-caused crashes distribution along major highways
- Number of speeding violations (with characterization of speed) by class of vehicle
- Annual number of CDL suspensions and/or revocations (with reasons for suspension or revocation)
- Comparison of average speed for drivers cited for speeding violations for CMVs and autos

Support Priority Setting

- Quarterly and annual reports on CMV crashes (fatal, injury, tow-away, significant vehicle damage) organized by causal categories

Support Issue Clarification

- How does CMV driver age impact the likelihood of fatal or injury crash? Do violation data help clarify the impact of this issue?
- How does CMV driver experience impact the likelihood of fatal or injury crash? Do violation data help clarify the impact of this issue?
- What is the fraction of two-vehicle crashes involving both a CMV and a POV that are caused by the POV?
- What are the crash rates for interstate and intrastate CMVs in State?
- How do the crash rates compare for all CMVs relative to those carrying HazMat?
- How have changes in speed limit impacted CMV fatal and injury crashes in State?
- How do lane restrictions impact CMV fatal and injury crashes in State?
- How does the density of traffic impact fatal and injury crashes in State?
- How are consequence data recorded for HazMat crashes in State?
- What is the correlation between overweight vehicles and OOS violations for vehicle or driver?
- How should quarterly "Special Traffic Enforcement" activities be selected (type, timing, location)? How effective are these activities?
- How effective are Compliance Reviews?
- How can the impact of special education initiatives be measured?
- How effective are judicial practices in holding problem drivers accountable for their behavior? Are CDLs of problem drivers withheld? Are problem drivers appropriately dealt with?
- What size companies contribute most significantly to risk, and how can resources be applied to manage these risks most effectively?

Support Core Resource Allocation

- Quarterly and annual reports on CMV crashes (fatal, injury, tow-away) by District and by causal category (What are the causal categories used in State?)

Other Measures Needed

- Assessment of the value of Compliance Reviews
- Measure of relative risk of trucks and motor coaches - need national data on fatal and injury motor coach crash rate (per million miles) as well as on the number of fatalities and/or injuries per crash